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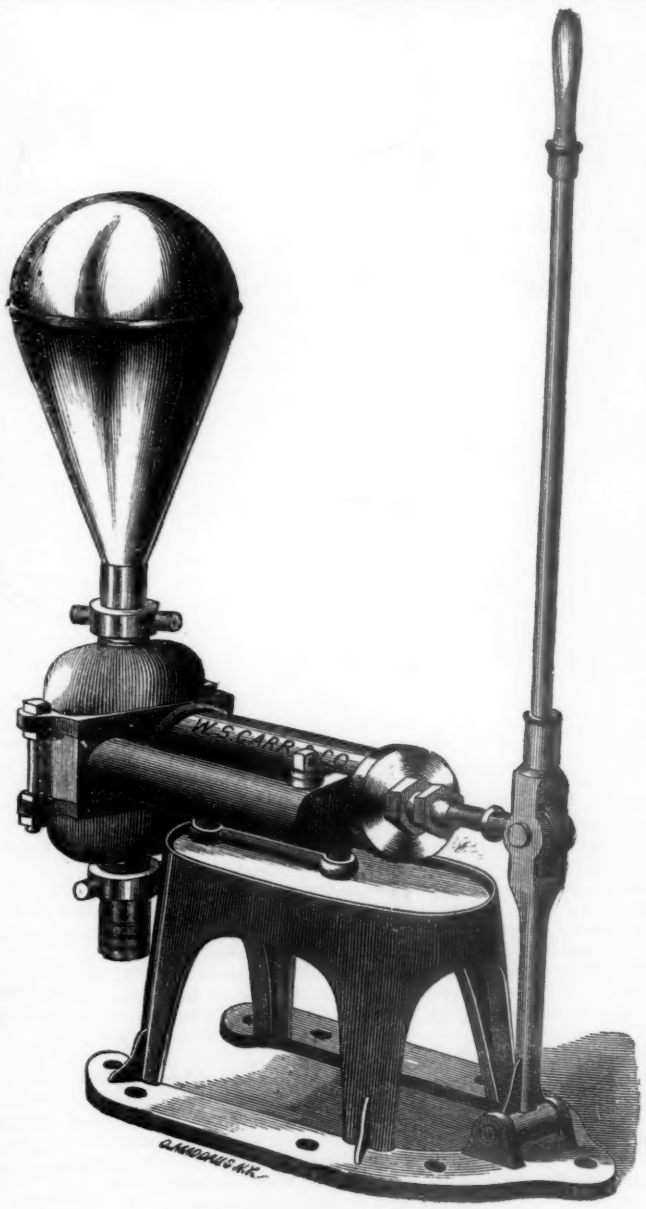
Pumps.

The importance of simple and efficient pumps, both in houses and on board ships, is too well understood to need comment. The general principles which govern the construction of pumps adapted to these purposes are sufficiently well understood, and have long been acted upon; but in the special arrangement of the parts, whereby efficiency may be combined with simplicity and consequent cheapness, there is still much room for improvement.

In the pumps which are illustrated in the accompanying cuts, the arrangement of the different parts is such as to secure these features with a great degree of success.

In fig. 1 the pump is horizontal, and is firmly attached to a cast-iron base or stand, which in turn may be screwed to a floor; or if a portable pump be wanted, to a movable stand of good heavy plank. The lever is vertical and can, consequently, be operated with great ease and rapidity; and as the pump is double acting, the piston forces the water both on its forward and backward movement; a steady and copious stream can be maintained by a person of ordinary strength and activity. Consequently, for ships, for raising water to fill tanks in houses, and even for throwing water to any part of an ordinary dwelling in case of fire, the pump is all that can be desired, and as it can be readily arranged so as to be quite portable, it forms a capital instrument for watering gardens, syringing trees, vines, etc.

The pump proper is formed entirely of brass, so that it does not readily corrode, while the pump is so well made in the first place, that there is very little chance of its getting out of order. It is so constructed that any derangement or deterioration of the packing is easily reached and remedied. The removal of two bolts gives perfect access to the valves, and even after long uses, there can be no repairs required which demand greater facilities than those afforded by the shop of an ordinary carpenter or blacksmith.



HORIZONTAL PUMP.

In fig. 2 the same style of pump is presented, but bedded into an iron frame, and on legs, to be operated either with power or hand. These are particularly adapted for locations where there is a likelihood of rough usage, as also where large quantities of water are required, as in factories, plantations, etc. There are four sizes of either of these pumps made, viz., 2 inch cylinder, 2½ inch, 3 inch, and 4 inch, and larger ones made to order.

Besides these double acting pumps, there are a great many pumps used for auxiliary purposes, where a smaller quantity of water, and consequently a smaller pump is required. One of these is illustrated in fig. 3, representing a single acting lift and force pump. Instead of the cumbersome plank or board where they used to be put on, these are bolted to a neat iron frame that can be easily transported and put up on any wall. The piston or rod works with a roller, and has a guide in the upper part of the frame, thereby securing the freest action, while no chance is left of binding, and the consequent hard working of the pump, as common with the old style of piston rods. By taking out three bolts and reversing the barrel, the pump can be made to operate either from the right or left.

For further information, address William S. Carr & Co., 106, 108 & 110 Centre st., N. Y.

For cuts 2 and 3 see next page.

Lighting Mines with Gas.—In improving the method of lighting mines, Messrs. M. Wilkin and J. Clark, of Paddington, propose, the *Builder* remarks, to use lamps, burning gas, oil, or other illuminating materials, with air propelled from a pure source at the bottom or top of the shaft, through air-tight tubes, to the interior of the said lamps. An overplus of air they cause to blow gently out by escape valves or covers near the top of the lamps, thereby preventing the entrance of foul air, or air which has become mixed with fire-damp. By preference, they glaze the lamps about half their height with glass; the upper half they prefer to make of sheet metal to withstand the heat. When gas-lamps are used, the gas is produced, and conveyed in pipes in the usual way. The air is propelled through the tubes referred to by any well-understood method; such as by fans, air-pumps, steam-jet, etc. In lighting the lamps they propose to use safety-matches, such as those manufactured by Bryant and May. After the match is inserted into the lamp by an escape valve, it is struck, and the lamp is lighted, while the match is extinguished in a tube into which it is thrust.—*Morgans Brit. Trade Jour.*

Many small basins of coal exist in the midst of the Rocky Mountains, not directly connected with the great coal-field along its eastern base, and we are ready to hear any day that some of these basins contain anthracite coal.

Petroleum Lamps and their Dangers.

We have, on several occasions, published articles on the dangers of petroleum lamps. The same subject is now engaging the attention of the English people, as will be seen by the following, which we take from *The Ironmonger*, an English journal:

To our minds it is perfectly clear, as the result of recent inquiries and experiments conducted by ourselves and by others, that the existing Petroleum Act does not in any satisfactory degree protect the public from liability to grave accident. We have already pointed out the general incompleteness of legislation on the petroleum question, and we have shown how easy it is for the vender to adopt Mr. Daniel O'Connell's suggestion to drive a coach and six through the Act. As if in confirmation of these views, we have the report of the chemist to the Mineral Oil Association, showing that the operation of the statute is *nil*. Out of 74 samples of petroleum purchased at different London shops, one-half were found to explode at a temperature below 100 deg.; in other words, these samples were all illegal, and the venders of them ought, under a proper execution of the law, to have been severely punished. But of course they were not punished, though they evaded the statute, and will most probably continue to evade it, till the destruction of a few families, or the burning down of half a dozen houses or so, rouses the authorities to a sense of the public danger.

But even were the Act thoroughly carried out, were we provided with a number of energetic inspectors, who determinedly went about from shop to shop taking "flashing-points," would the danger be removed? To this question we feel disposed to answer—No. Doubtless the restriction of the use of coal-oils to those which give off an inflammable vapor at 100 deg. Fah. is a useful enactment, since it removes a very great proportion of the low density oils from the general consumption; and we earnestly trust that ere long the Act will be put into such effective operation that none but oil of this class shall be sold. Is there not, however, still a very great deal of danger that explosions may occur? To this it may be replied, that under ordinary circumstances it is not so. But under certain conditions, and they are not at all unfrequent, explosions can and will occur, be the Petroleum Act never so vigorously enforced.

If our readers are at all familiar with the petroleum lamps of cheaper construction—those, for example, to be found so commonly in the houses of the poor—they will have noticed how rude and imperfect these are, both in principle and manufacture. Three points present themselves for notice in the construction of these lamps which especially deserve attention, since they are related to circumstances calculated to give rise to explosion. In the first place, the burner of the lamp is so arranged that it has a direct metallic communication with the basin or bowl containing the oil; in the second, the aperture through which air is admitted to supply the place of the liquid consumed is unnecessarily large and close to the flame; and thirdly, the tube in which the wick is placed is generally so much larger than the wick that a wire of considerable size might directly be thrust down from the flame to the petroleum beneath. These may appear trivial peculiarities, but they are in our opinion just the opposite, and are the sources of many accidents which, were they rectified, need not occur, even with oil of very low flashing point. Owing to the high temperature produced during combustion in most petroleum lamps, the brass work becomes heated some hundred degrees, so that, indeed, it is quite impossible to touch it. This heat is communicated to the bowl, and from this to the petroleum, which then volatizes rapidly. The next step—in cases where inferior oil is used—is that the vapor, in passing up through the vacant space in the wick-tube or through the air-hole, becomes ignited at the flame, and that thus, like the powder in the touch-hole of a gun, the mixture of air and vapor in the bowl becomes ignited, and, expanding with violence, bursts the bowl into atoms, and scatters the burning, and inextinguishably burning liquid, over everything in the neighborhood, carrying destruction with it nearly wherever it goes

Now our legislators say this is all avoided by using the oil prescribed by the statute. "Such oil is never heated to 100 deg., and never gives off inflammable vapors." To this we reply, firstly, that in inferior lamps, burnt for many hours, and with the flame, as generally is the case, at a great height, it is quite possible to have the oil raised to 100 deg.; and hence that the statute does *not* protect us. But seeing that the statute is practically inoperative, and that cheap oils will always find a market, and that there is no reason why even cheap oils should not, if possible, be utilized, we think that something should be done in a direction different to that taken by the legislature; we mean in the direction of the lamp itself.

What is there to prevent our constructing a lamp in which the present legal oil, and even inferior kinds, may be burnt with safety? We ourselves see nothing. There are three provisions to be made. Firstly, we should seperate the burner from the basin by a ring composed of some very bad conductor of heat; secondly, we should provide that the "wick" should fit the tube exactly, and that some fixed and permanent wick, such as those made of asbestos or fine wire, should be employed; and lastly, we should adopt the well-known principle of the Davy lamp in the case of the air-hole (always covering this, whatever its size, with a piece of fine wire gauze). In a lamp so constructed we should not fear to burn the worst oil now in commerce. It would be perfectly safe, while existing forms of lamps are not; and we trust, therefore, that our makers will take the hint and do that which Government ought to have done, but which, of course, it did not. "How not to do it" might have been very well in the days of the *State*, but in these days of the *Nation*, the phrase should be allowed to become obsolete.

Fig. 2.

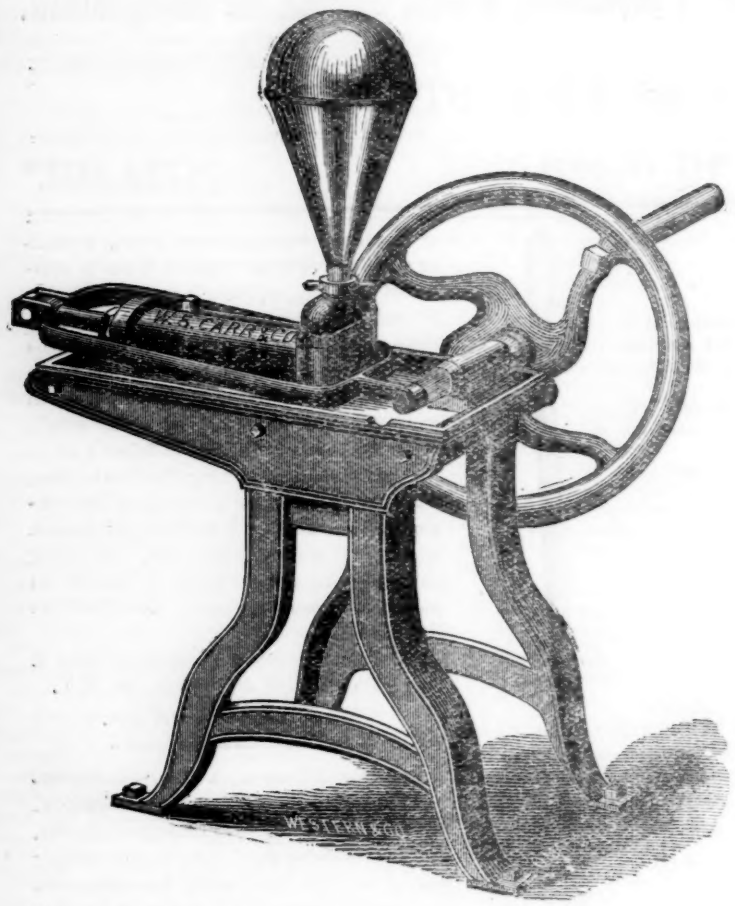
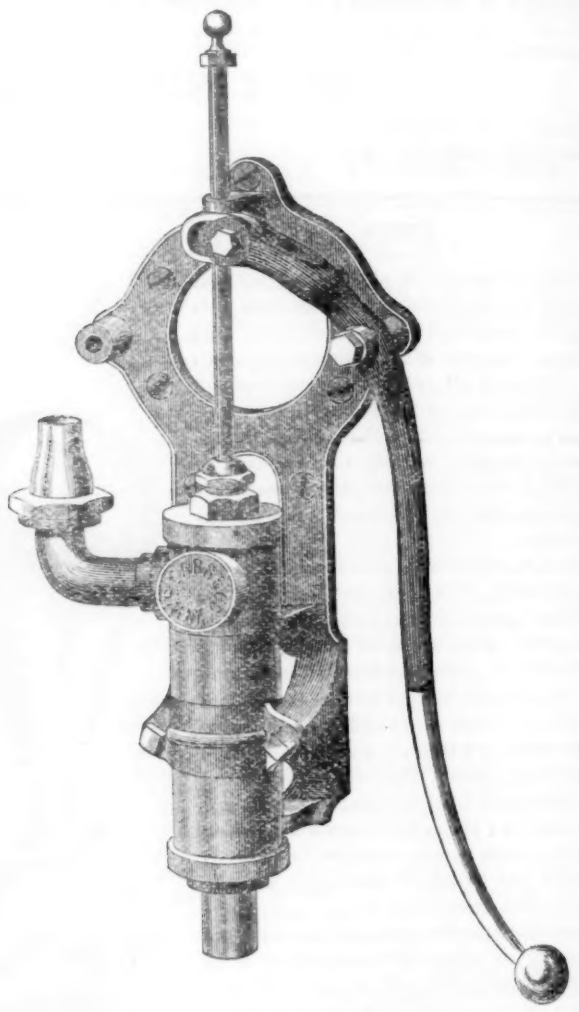


Fig. 3.



Phosphoric Light.

So far as principle goes, is dependent on the fact that when ordinary wax-like phosphorus is burnt in air white and solid phosphoric acid is produced, and this combustion is attended by the production of an intense light. Every schoolboy knows that the light emitted when phosphorus is burnt in pure oxygen is still more brilliant. Mr. Winstanley sought to utilize this fact with a design of obtaining a powerful light for photographic purposes, and carried out the idea in the following way: A quantity of the wax-like variety of phosphorus was placed in a suitable vessel; through this vessel a current of coal gas was passed, the direction of the stream being so regulated that it could pass over the phosphorus and then escape through a jet fitted for the purpose. When the coal gas is passed over the phosphorus at ordinary temperature, and then ignited at the jet, it of course burns with its usual flame: but when the phosphorus is heated it commences to volatilize, the luminosity of the flame greatly increases,

owing to the combustion of the phosphorus vapor, and fumes of phosphoric acid are produced.

Winstanley pointed out that, though this phosphoric gas flame gave a light of much greater brilliancy than that of ordinary ignited coal gas, yet the intensity of the light could be greatly augmented by feeding the phosphoric flame with pure oxygen. When this was done, report says: The brightness of the flame was enormously augmented, and the ample room in which the experiment was conducted became brilliantly illuminated." We congratulate Mr. Winstanley on his ingenious and successful experiment, and hope that further results may flow from such well-directed efforts.

There are just two points that we must for humanity's sake touch upon here. Those of our readers who have not had much experience in the more dangerous class of chemical experiments little know what a disagreeable substance phosphorus is to manipulate with; and it is only good and careful experimenters like Mr. Winstanley who may venture to use this new gas flame. We must confess to a great antipathy to employ any more phosphorus than is actually necessary, as in our juvenile days we received a burn of such severity that the strong scar still remains to warn us when chemical proclivities would tempt us to forget our former experience and meddle with this dangerous body. We would, therefore, caution the more inexperienced of our readers against meddling with our new but treacherous ally.

Again, the product of the combustion of phosphorus with free access of air is a highly irritating acid, or, rather a white smoke, which becomes a powerful acid on coming in contact with the moisture always present in the air. A little of this smoke, when allowed to escape into the atmosphere of an apartment gives rise to a most disagreeable choking sensation. This latter objection to the use of the phosphoric flame could of course be to a great extent removed by the employment of a suitable chimney communicating with the air external to the apartment. We may add, that any disagreeable fumes escaping removal by the chimney can be quickly rendered harmless by a little liquid ammonia placed in a shallow dish near the apparatus.

Having said so much about Mr. Winstanley's plan, we now come to the suggestion of a friend, to try the effect of a volatilizing magnesium by heating the metal very strongly in a stream of hydrogen, and then to ignite the gas as it issues from the vessel containing the heated metal. It was anticipated that in this way a brilliant magnesium light would be obtained, owing to the combustion of the metallic vapor along with the gas. It is obvious that zinc might be employed in the same way, since it is about as volatile as magnesium.

In the first instance, we placed some metallic magnesium in powder near the end of a tube of very hard and infusible glass, the portion of the tube immediately beyond the metal having been drawn out to a fine jet. A current of hydrogen gas was then passed through the tube and ignited at the jet; of course the gas then burnt with its usual nearly colorless flame. The glass tube was now heated close to the jet, so as to melt the magnesium; but the only difference observed in the flame was a tinging with yellow. The blast of a powerful gas table blow-pipe was now brought to bear on the tube, and the temperature so raised as to render the glass tube very pliable; the gas flame had now become of a bright yellow color, with occasional flashes of bright white light—probably due to particles of magnesium having been carried forword by the current of gas. The yellow color was found, on examination with the spectroscope, to be due solely to the presence of sodium. The amount of magnesium vapor which ultimately reached the flame was extremely small.

Having failed on a small scale, we repeated the experiment with the aid of a powerful wind furnace and a stout metallic tube, but the result we obtained was little superior to that already mentioned; so that, for all practical purposes, Mr. Winstanley's plan fails in the case of magnesium.

The principle of the method followed in the above instances has received less attention than it appears to deserve at the hands of those interested in the production of cheap and brilliant artificial lights, and we hope now to see it extended in some useful direction.—*Brit. Journal of Photography.*

To Clean Paint.—There is a very simple method to clean paint that has become dirty, and if our housewives should adopt it, it would save them a great deal of trouble. Provide a plate with some of the best whiting to be had, and have ready some clean warm water and a piece of flannel, which dip into the water and squeeze nearly dry; then take as much whiting as will adhere to it, apply it to the painted surface, when a little rubbing will instantly remove any dirt or grease. After which, wash the part well with clean water, rubbing it dry with a soft chamois. Paint thus cleaned looks as well as when first laid on, without any injury to the most delicate colors. It is far better than using soap, and does not require more than half the time and labor.—*Manufacturer and Builder.*

Chemical Repertory.—No. 30.

MAY 16, 1870.

Editor—HENRY WURTZ.

[*Original Communication.*]

THE LIGHTNING-ROD CONTROVERSY.

[DR. BUSHEE IN REPLY TO DR. VAN DER WEYDE.]

[*Concluded from page* 132.]

If from any cause it becomes difficult or impracticable to form a thorough connection, then I would urge the proposition, which I acknowledge "*was* seriously made in Salem,"—the use of discharging points to diffuse the electricity into the atmosphere near the ground.

DR. VAN DER WEYDE, however, attempts to show that such points are useless.

He says: "If we consider that a thunder cloud charged with positive electricity, causes the nearest part of the conducting earthy crust, either on or at a distance below the surface, to become negative by induction, that both are thus nearly equally charged by opposite electricities, and that the only function of the lightning-rod is to establish such a conducting communication between the two (the cloud and the moist earth below the surface), so as to cause the two opposite electricities to flow together, and thus to neutralize one another (. . .) *the* ABSURDITY *of these lower points becomes evident.*"

It is difficult to see how this reasoning renders the absurdity of points evident—how any law of induction in the case supposed can affect the efficiency of points in diffusing a charge of electricity.

True, the "function of the rod" is to establish a conducting communication between the cloud and moist errth, and such a *perfect* communication as to convey the entire charge freely, but the rod does not always perform this function fully. It is then the points are called into action.

Induction, like conduction, is merely *relative*; depending upon the proximity and intensity of the charged body.

In ordinary cases the electrified cloud is above the highest point of the rod, and the rod may extend thirty, fifty, or even a hundred feet, as the case may be, above the ground or lower points; consequently there could be no inductive action to prevent the escape of electricity from the lower points. While, therefore, the upper points are receiving electricity from the cloud, the lower points may impart it to the atmosphere in case of an overcharge of the rod.

There are doubtless hundreds of well authenticated instances in New England in which some portion of the charge has left the rod, doing more or less damage to the building, usually near the ground, or leaving at least some indications that the rod had been overcharged.

In all such cases I claim that points would be valuable aids in relieving the rod, and thus preventing lateral discharges through the house.

In case of defective ground connections, the Dr. thinks, "the clouds, the house, and the air around it, are all most likely charged with the same electricity, especially when the air is saturated with moisture. In this state of affairs, the isolating intervening substance in place of being the air, as usually the case, is then the dry ground under the house."

What then would be the difference between the cloud and the air around the house?

If the cloud or air charged with electricity and saturated with moisture surrounds and envelopes the house, lying so low, even upon the ground, as to subject the upper and lower points of the rod to the same electrical tension, so that the electricity would have no tendency to pass either way upon the rod, then I acknowledge the "*absurd*" points would be of no account, nor would the rod itself be of any use whatever, for the house, under the supposed conditions would, as I conceive, be in no danger from lightning—the air being saturated with moisture, the surface of the ground and vegetation would naturally be moist also, and the electricity of the surcharged air would soon find its way into the earth through more direct and natural channels than by perforating "the dry ground under the house."

Again, the Doctor says, "both the extent and the charge of a thunder cloud are too great to be appreciably affected by the small amount of electricity the air around the house may absorb, if it really does absorb it, *but this is extremely doubtful.*"

As to the great extent of the cloud and the corresponding amount of electricity that may sometimes exist in the atmosphere there can be no question.

It is, however, an error, in my view, to suppose that "the whole amount of electricity of the cloud, etc.," is discharged at once, either by explosion or by gradual current through pointed conductors.

The quantity of electricity discharged usually at any one time, by a lightning rod, or in what is generally understood as a "flash of lightning," may bear a very small proportion to the entire amount in the cloud, or may stand in almost any ratio to this amount, depending upon the extent of the cloud and other circumstances.

This question, it is believed, has too often been the subject of very vague ideas and extravagant hyperbole, yet it is one of much practical interest in its bearing on the construction and arrangement of lightning rods, and especially on the point at issue,—the utility of discharging points. The limits, however, of this communication (already too much extended) forbid further discussion here in relation to this.

As to the fact that points are capable of imparting electricity to the atmosphere, or that the atmosphere is equally capable of receiving it. I cannot conceive how DR. VAN DER WEYDE can doubt either the one or the other. To doubt such facts, as is seems to me, is to deny the truth of the most familiar laws of electrical science, and to discard the very principle upon which the application and utility of the lightning rod depends.

The Doctor finally finds "the whole question" of lightning rods "in a nutshell," and says, "the error is the mistaken notion that *the real lightning rod is the point* on the top of the house." I know not how prevalent this idea is, but I have never met with any person, to my knowledge, who entertained such a "notion."

He considers that "*the real lightning rod is the perfect ground connection.*" The upper part, he thinks, may even be omitted, "but without the true lightning rod below deep down in a spring or well, or in the moist earth, the whole thing is a most dangerous affair."

Here I am glad to find the Doctor gives the most decided sanction to one of the prominent points for which I am contending, *a more thorough ground connection;* which is effected by the true lightning rod *deep down in a spring or well,* or moist earth, implying again that care should be taken, in making the connection even with a spring or well, and unless this is properly done the whole thing is a dangerous affair. In this I cordially agree with DR. VAN DER WEYDE.

But I do not accept his view that the upper part of the rod may be *omitted,* leaving the part out which makes *the perfect ground connection,* which he calls the *real lightning rod.*" I prefer to consider the true lightning rod as made up of all its parts—the point above, the middle, and the lower part, which makes the perfect ground connection. For it is difficult to see how the lower part alone, the Doctor,s "true rod," (if I understand his meaning,) could perform the functions he ascribes to a rod when there is a deep stratum of insulating atmosphere between the cloud and the earth's surface, as the Doctor admits is usually the case.

In the course of DR. VAN DER WEYDE'S remarks to prove the "absurdity of points," he says:

"*If it (the rod) is only buried a few inches in the dry earth, as many ignorant constructors make them in this country,* there is great probability the stroke will follow some other course and do damage."

In this expression the Doctor has conceded the truth of the central idea of my first paper on lightning rods, viz.. *the bad practice is a defective ground connection;* and he has done it in a more sweeping statement than I ventured to make; but I am happy to find that we fully agree in all the main points. Those in which we appear to differ are, I consider, of less importance, though in many respects of much interest. In the course of this communication I have endeavored to notice the most prominent points of difference, and to discuss them fairly and candidly; and if I have misunderstood the views of DR. VAN DER WEYDE, or have in any case misrepresented them, I hope to be corrected.

JAMES BUSHEE.

Worcester, Massachusetts.

[*Original Communication.*]

ANSWER OF PROF. VAN DER WEYDE TO PROF. WALLING'S SECOND REJOINDER.

[*Concluded from page* 132.]

I said that we cannot dissociate motion from matter, because "there can be no motion, nor even an attempt at motion, nor tendency to motion, where there is nothing left to be moved." Professor WALLING says he can see no other meaning in this than that "if motion is attributed to a cause independent of matter, matter must in consequence cease to exist." This surprises me. My logic is just the reverse; it means simply what I said: Motion cannot exist without matter, and where there is no matter, motion must cease to exist, *ergo,* force also; as, after my fundamental principle, force is nothing but *matter in motion;* and I am prepared to carry this through consistently, in all my arguments.

The whole point of difference is that Prof. WALLING cannot possibly associate with the word force this simple meaning, but persists in taking this word in a cer-

tain metaphysical sense, to which he seems to have become habituated. I confess that my mind is so constituted, that this idea to which I once myself adhered no longer satisfies me. I have come to the conclusion that the true road to progress in the science of physics lies not towards abstract hypotheses of caloric fluids, luminiferous or electric ethers, or forces capable of moving bodies, all having an independent exi-tence in space The index-hand of modern science points in a very different direction; namely, towards the study of *matter* and *motion of matter*, and nothing else, dropping all metaphysical assumptions, of which matter is not the basis.

And, as I believe that what is directly observed by human senses is sufficient to explain the known facts, as well, if not better, than by assuming entities unperceived by senses, I consider these ideas unnecessary and uncalled for, to say the least. However, it would require treatises as long as the papers Prof. WALLING attempted to read at Salem, to point out how the difficulties raised by HERSCHELL may be disposed of. In fact HERSCHELL is in the same fog. He confounds elasticity with force, and with collision; asserts that in collision "*vis viva* is destroyed, disappears, is lost and gone forever."* With all respect to this eminent astronomer, I cannot look up to him as authority on this subject; in fact, in a subject like the one in question, we must not found our opinions upon authorities but upon the accumulated *facts;* and when these fail to give us a clear insight into the causes of things, then I agree *perfectly* with HERBERT SPENCER, in drawing a sharp line of distinction between the knowable and the unknowable. Among the latter I count the nature or essence of the existence of matter as well as the nature or essence of force, or rather gravitation, which is the cause of all force, and beyond which we cannot go. This last was actually NEWTON'S opinion.

To show how my definition of *Force*, to which I have adhered for many years in my lectures on Mathematics and Mechanics, may be consistently carried through, would require either a new textbook on Mechanics, or a course of lectures; and is therefore altogether beyond the scope of the present discussion, which, however interesting in itself, will certainly be considered by many in this eminently utilitarian land, as occupying wasted space and time.†

I have found that my definition has been a reliable preventative against spiritualism, perpetual motion, and other delusions, to which my pupils were never liable; as the idea of the incidental association of independent existing forces was totally excluded; maintaining, as it did, that weight, pressure, elasticity, etc. were only stored-up forces, not actual forces at all; that they only become real forces when used, and producing motion in matter. In the same way as that the buried treasure of the miser is no actual wealth when never used (the miser meanwhile living in misery), but only becomes wealth when it passes judiciously, from his hands to others, so we, in availing ourselves of the forces of nature, draw ultimately upon gravitation, the sole origin of all motion of matter, of all orce.

P. H. VAN DER WEYDE, M. D.

P.S.—Since writing the above I have received a new publication of Prof NAUMANN of Giessen, which confirms my views on latent heat, etc; it is entitled, "*Grundriss der Thermochemie*," Braunschweig, 1869, and contains a full theory of the relation between caloric and chemical processes, taken from the new point of view of the mechanical theory of heat.

* *Vide:* Familiar Lectures, page 64, et seq.
† In this we do not concur with the distinguished writer.—ED.

American Chemical News.

FARMER'S THEOREM.

CORRESPONDENCE.

SAN FRANCISCO GAS WORKS, April 30th, 1868.

WILLIAM FARMER, Esq.:

Dear Sir,—In reply to your favor of the 6th inst., I would state that I distinctly remember Mr, HENRY H. EDGERTON'S letter to me of February 27th, 1868, suggesting the squaring of the gas consumption in computing illuminating values. I was very much hurried at the time of its receipt, and regret my consequent neglect of his first communication: the *second* note to which he refers I do not remember.

A close analysis of this theorem satisfies me that it is absolutely, or at least very nearly, correct, within such reasonable limits as are likely to occur to a practiced photometrician; and its paternity should be a matter of pride to Mr. EDGERTON and yourself, who are, as I believe, its original and independent discoverers. My own opinion is that Mr. EDGERTON is fairly entitled to priority of publication, as his letter to me (of Feb 27, 1868,) sufficiently chalks out the rule which Mr. SILLIMAN has put in words. And I am the more inclined to this view from the fact of my almost daily association with you during the winter of 1867-8, and the likelihood that you would have mentioned the idea to me had it been in your mind at the time *Priority of publication*, Mr. EDGERTON would certainly have secured had I attached the importance to his note which it deserved, and he should not lose the credit by reason of any oversight of mine.

The closeness of the argument by which form and substance, and verity have been given to the "Theorem," is, in my judgment, all your own; the "Theorem" itself is fairly his. It is the "Edgerton Theorem," notwithstanding that you are equally, or nearly so, its discoverer, and have been the first completely to elucidate it.

I am satisfied that the new rule accounts for many, if not all, the phenomena of distilling the *very* rich cannels mixed with common caking coals—in other words, that boghead gas, for instance, has been enormously underrated heretofore by the custom of calculating by simple proportion from very small volumes of gas consumption. (Vide CLEGG, 4th ed., pp. 74 5.)

I write this hurriedly to send it as it stands, that my own ideas may reach you at once.

I am well advanced with the "Synopsis," and would have had it in the printer's hands before this but for a notice that some one else had taken it up. If this is a mistake, I shall of course complete it at once.

I am sorry to hear of Mr. SABBATON'S illness, and will write to him to-morrow.

Yours sincerely,
JAMES R. SMEDBERG,
Consulting Engineer S. F. Gas Co.

ORIGINAL COMMUNICATION.

NEW YORK LYCEUM OF NATURAL HISTORY.

(CHEMICAL SECTION.)

AMMONIUM AMALGAM AND HYDROGENIUM.

At the meeting of the Chemical Section of the New York Lyceum of Natural History, May 9th, Prof. C. A. SEELY read a paper "On the Constitution of Ammoniacal Amalgam," of which the following is an abstract:

Ammonium amalgam was discovered by BERZELIUS in 1808; and immediately after by PONTIN, SEEBECK and TROMMSDORFF. Its easy preparation, singular properties, and its relation to current theories, have made it familiar to all chemists. It led to the adoption of AMPERE'S ammonium theory, gave a great impetus to the theory of organic radicals, and revived the notions of the alchemists of the compound nature of metals. Early in this century it led many to conclude that the base of nitrogen is a metal; and at the present time, without doubt, has assisted in giving currency to the notion that hydrogen is a metal. Except for it, perhaps the crudity, hydrogenium, would not have been inflicted upon us. Of course it has occupied a conspicuous place in chemical literature; scores of papers, and at least two books, have been printed about it.

The name ammonium amalgam expresses the supposed constitution of the subetance; the radical ammonium is represented as dissolved in or united with mercury. The ammonium is, moreover conceded to be a solid or a liquid, and to have a truly metallic character. Thus the latest and best authorities present the case. It is described in nearly all treatises on chemistry, as if its constitution was as certainly ascertained as that of common salt. There have been from the beginning, however, those who doubted the prevailing ideas, and some (see DANIEL'S *Chemical Philosophy*, p. 520, and Dr. WETHERILL on Ammonium Amalgam, in *Silliman's Journal*, vol. xl, p. 160) boldly objected to them, but the reasons they alleged had not sufficient weight. Ammonium amalgam has always been a pet with chemists; it has always been ready for the service of one theory or another. The ammonium theory, the radical theory, the nitrogen and hydrogenium theories, have each in their turn been of too much importance to permit any of their props to be withdrawn.

The author considers the so-called ammonium amalgam to be a mechanical or physical mixture of liquid mercury, with the gases ammonia and hydrogen and that its semi solid consistence is due to the mixture having the nature of a froth. When sodium-amalgam is brought into a solution of sal ammoniac (the ordinary method of preparing ammonium amalgam) the chlorine combines with the sodium, and the residue ($NH_3 + H$) of the sal ammoniac is set free all over the surface of the mercury. The particles of the mixed gases adhere to the mercury, and by reason of the movement bringing to the surface fresh mercury, they become enfilmed and carried inward, until the mixture becomes a homogeneous froth. The principal considerations by which this view of the constitution of ammonium amalgam has been reached, are as follows:

1st. The volume of ammonium amalgam is inexplicable in any other way; it is utterly inconsistent with the well established laws of combinations by volume. There is no case of a liquid or solid chemical compound, or amalgam, which has any analogy to it.

2nd. Mercury has a mirror like surface, while ammonium amalgam has comparatively a whiter and more dead surface; it approaches in appearance to matt silver. Such changes are characteristic of froths.

3rd. If ammonium amalgam be subjected to varying pressure, its volume changes apparently in accordance with MARIOTTE'S law of gaseous volume. To illustrate this important fact, a glass tube one-third inch in diameter, twenty inches long, and fitted with a plunger, was employed. Mercury containing a little sodium was poured into the tube to one third inch in depth, and upon this was poured a strong solution of chloride of ammonium, occupying about two inches in length of the tube. The ammonium amalgam was completely formed in a few minutes, and occupied several inches of the tube. On adjusting and depressing the plunger, the volume of the amalgam progressively diminished till it closely approached the original volume of the mercury. Also it was notable that the amalgam progressively gained fluidity and the mirror surface, till at the greatest pressure it appeared like mercury. On withdrawing the pressure the original volume and appearance of the compound were resumed, and on reducing the pressure below that of the air, the amalgam still expanded, until it rose above the surface of the liquid in the tube. If the great pressure be maintained, more ammonium amalgam will be formed, the mass expanding progressively apparently in accordance with the fact that the absorption or adhesion of gases to liquids is favored by pressure. By means of the simple apparatus used a pressure of ten atmospheres, or a good vacuum are easily and at once attainable, and the experiments with it are very striking.

The so-called ammonium amalgam is therefore not an amalgam at all; ammonium is not proved to be a metal, and if it be admitted that the monatomic radical really exists in ammonium amalgam, it is neither a solid nor a liquid but a gas.

The considerations regarding ammonium amalgam are evidently equally applicable to LOEW'S hydrogenium amalgam; both are only metallic froths. The expansion of palladium observed by GRAHAM, on its absorption of hydrogen, is probably analogous to the case in question. In both cases the gases concerned are condensed by reason of their attraction to the metal; and if the molecules of palladium were made free to move, as those of mercury, it is probable that GRAHAM'S hydrogenium alloy would become a palladic froth, more remarkable than the corresponding mercuric froth. Many have erroneously supposed that hydrogen was conspicuous in its capability of being absorbed by metals, and thus have more readily been infused with the hydrogenium theory. Oxygen has an eminence over hydrogen in that property, and yet no one has a theory of oxygenium. Iron absorbs carbonic oxide, but no one is bold enough to suggest that carbonic oxyde is a metal.

A Great Tunnel Projected.

Burrowing under the ground seems just now to meet with much favor from engineers, especially upon and around the island of Manhattan. In May, 1868, a charter was granted by the Legislature of New York, incorporating the Brooklyn Iron Tubular Tunnel Company, for the purpose of making a tunnel across the bed of the East River. Nearly a year afterward, another enactment changed the name of the organization to that of the New York Tunnel Company, and enlarged its object to embrace the construction of tunnels crossing under both the North and East Rivers, these to be connected by a tunnel passing under New York city. This legislation has been supplemented by an act passed by the Legislature of New Jersey, permitting the completion of and access to the Jersey end of the subterranean line. The National Government has been appealed to for help in the indirect way of declaring the tunnel a post-road, an act to this effect having already passed the House and being now before the Senate, with, it is said, strong probabilities of a speedy passage.

The manner of carrying out the work has not yet been fully decided upon. The tunnels across the rivers may be formed in either of three ways; by boring under the river beds; by dredging passages in which the tunnels may be laid or built of iron or masonry, and finally more or less covered with earth; or simply formed of iron tubes arranged upon the river-bottom and overlaid with brickwork and cement. The rivers are each fifty to sixty feet deep at the points where the tunnels are intended to cross, and if either of the two last named plans is adopted, submarine operators will have an important part in the performance of the work. Those interested in the enterprise declare that it will be set on foot by actual excavations during the present spring, that it will cost far less than the proposed East River Bridge, and be completed long in advance of it. The success of the undertaking rests wholly upon the amount of capital that can be drawn into it and the patience of its projectors, inasmuch as it is only in magnitude that it differs from other engineering works that have been prosecuted to a successful issue.—*American Artisan.*

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—EDS.]

Complimentary.

CINCINNATI, April 14, 1870.

Messrs. Editors: Enclosed you will please find $3, being my subscription for the GAS LIGHT JOURNAL. I am pleased to say it is a really valuable paper; one I would not like to be without. I am expecting to be in New York in May and hope to have the pleasure of seeing you. Yours very respectfully,

R. T. COVERDALE,
Engineer and Contractor for the Erection of Gas Works.

Complimentary.

NEW ROCHELLE, April 29, 1870.

Messrs. Editors: The three volumes of the GAS-LIGHT JOURNAL sent you a short time since has just been received by me, bound in a manner which gives me *perfect* satisfaction, and it is with pleasure that I send you the enclosed check, which will pay for one year's subscription for the Journal, together with the expense of binding volumes 9, 10 and 11. Yours truly,

CHARLES VAN BENSCHOTEN.

Freaks of Lightning with Gas.

ZANESVILLE, O., May 7th, 1870.

Messrs. Editors: In reading the discussion on Lightning Rods now going on in your journal between Drs Bushee and Van der Weyde, I was reminded of an accident that occurred here, in the Western Union Telegraph Office, in the summer of 1868, and at a time, too, when the operator did not think it necessary to cut off his connection by the ground wire, which is generally done by hooking to the gas pipe or burner. There were some eight wires entering the office, all connecting with the switch board, which was on the front wall directly over the operating bench, and between two windows. On the right some six feet, and four feet back, was another operating bench, and some three feet above this was a gas bracket, the pipe of which leads to the meter in the side hall and near the front window. The electric fluid came in on the wire, melted the connection with the magnet, passed some six feet to the gas bracket and through the pipe to the meter, melting a three-eighth inch lead pipe, setting the gas on fire, which blazed up some three feet, and in all probability would have destroyed the building had it not been seen through the window by persons in the street who gave the alarm. The operator did not know that any accident had occurred, except the little damage done to his magnet. The above fact may give some idea of what *might* happen in connecting lightning rods with gas-pipe.

Respectfully yours,

A. C. ROSS.

[The phenomena involved in this incident are entirely novel to us, and will doubtless be so to the majority of our resders. To telegraph operators this little history wilt convey a lesson of caution in the management of their wires during electrical storms.—EDS.]

New York Society of Practical Engineering

This society held its usual monthly meeting in the Cooper Union, Wednesday evening, April 20, the President, James A. Whitney, in the chair.

C. Williams, C E, of this city, read a paper on Old and New methods of City Transit. We give below a few salient points of the writer's essay.

About forty years ago, a one rail elevated railway was proposed in England, in which the car was to be made in two parts, to be run astride of the rail and be drawn by horses traveling on the ground below. This was improved upon by an American inventor, Uri Emmons, of New Jersey, who suggested the employment of steady rails at the sides of the line of supporting posts to steady the bottom of the car and prevent oscillation. Such a line would be as straight and as easily kept in order as the two rail track of the West Side Railway, which is sustained upon a single range of pillars. The writer, however, did not favor any particular form of elevated railway, so called, but thought an overhead way upon Broadway, accessible by stairs and hoists, and furnishing facilities for side-walks and double tracks, would best meet the requirements of travel in New York City.

As to the mode of propulsion for city cars, the writer gave the preference to some application of pneumatic pressure. Wire rope traction, as commonly applied, he held inadmissible; but the rope traction plan may very likely succeed if some means of gradually attaching the car to the rope, to avoid shock in starting, etc. is adopted. To this end it has been proposed to connect the car with the rope by drums or catch-pulleys, which are allowed to run on their shafts when the cars are not in motion, but which, when ceased to revolve, constitute a rigid attachment. In these cases the ceasing of the drum or pulleys would be gradually done by means of friction brakes. Of the three atmospheric plans of tanks charged with compressed air carried by the cars and replaced by other tanks when exhausted; of a piston moving in an air tube and driving the car by a connection working through a longitudinal valve in the tube; and that formed by combining the two others by the use of air tanks automatically filled at intervals by automatic communication with a tubular reservoir along the track—the first is inadmissible, because of the great size and weight of tanks required to drive the cars for any considerable distance; the second has the drawback of great leakage at the valve, which led to its being given up in England, although a speed of 70 miles an hour was, in one instance, at least, attained with it; the third has never been tried in practice, but theoretically has points of practical utility. The two last named systems are legitimate subjects of invention, and may, the writer thought, yet find a recognized place among the acknowledged successes of engineers.

Steam Boiler Inspection.

It seems to be a settled fact that consumers of steam cannot be relied upon to keep steam boilers in such a state of repair as to render them approximately safe. If any proof of this is wanted, let the reader search the files of any daily newspaper for boiler explosions during the past year, and their causes, so far as ascertained. We avow that no intelligent man, who understands the nature of steam, and the common causes of boiler explosions, can make such an investigation without adopting the view that ignorance and avarice are still so powerful their influence upon the acts of mankind, that no dependence can be placed upon individual effort to secure life and property from the danger arising from impaired and unsafe boilers.

It also seems to be generally admitted that, in order to secure such safety as is attainable under the conditions pertaining to the general employment of steam as a motor, some system of inspection is necessary; but there are conflicting views as to the best method.

It is maintained by some that the most effectual mode would be to vest the power of inspection in those interested to discover faults. Thus it has been proposed in Chicago to give the matter of inspection over to the care of a boiler insurance company. A petition has been signed in that city by many respectable owners of boilers, praying that the inspection performed by the company mentioned may be legalized. Whether the company desire to be clothed with this additional power we are not informed; but in any case the change proposed seems to us impracticable, and unsuited to secure thorough and impartial performance of duty.

Inspection, to be valuable, must be general in its application, and particular as to each boiler, without fear or favor, on the part of the inspector, whose powers must necessarily be somewhat arbitrary. A liberal salary ought to be paid each inspector, so that not only men competent for the position can be obtained and retained in office, but so that the office of inspector may bo rendered sufficiently valuable to secure the honest performance of duty. The office should, moreover, be permanent, and only to be vacated by resignation or impeachment, or by neglect, or the too arbitrary exercise of duty.

The system of boiler insurance is deservedly increasing in popularity, and has done a great deal of good, from the dissemination of knowledge in regard to the real causes of explosion and modes of prevention. We think, however, a direct blow would be struck at the usefulness of boiler insurance, were the officers of companies of this kind legally authorized to perform inspection and make arbitrary requisitions upon boiler owners.

A system, whereby thorough and honest inspection can be secured, is very much needed, and we believe will never be attained except by the payment of liberal salaries to fully competent inspectors.—*Sci. Amer.*

Gas Items.

Price Reduced.—The following gas companies have reduced the price of gas, from the 1st January, 1870, as follows: Boston Gas Co, from $3.25 to $3; Lowell Gas Co., from $3.50 to $3.25; Jamaica Plain Gas Co, from $5 to $4.50.

Dividends.—The following dividends were declared 1st January: Newton and Watertown, 3 per cent. annual; Dorchester, 2½ per cent. annual; Jamaica Plain, 4 per cent. semi annual; Brookline, 4 per cent. semi annual; Boston, 2½ per cent. quarterly; Roxbury, 2½ per cent. quarterly.

Increase of Capital.—The Springfield and Dorchester Gas Light Companies have applied to the Massachusetts Legislature for increase of capital.

Exhausters.—The following Eastern Gas Companies have put in Exhausters during the last year: Springfield, Worcester, Charlestown, Salem, Lynn, Malden, Newton and Watertown, Woonsocket, R. I.; and Manchester, N. H. All of the Smith & Sayre Manufacturing Company's make.

[The above valuable items should have been published before, but were mislaid. They were kindly furnished by Mr F C Sherman, the very intelligent and gentlemanly Superintendent of the Brookline Gas-Light Company, Brookline, Mass. It would very much please us to have any of the Superintendents and Engineers, or others of the gas fraternity, imitate the example of Mr. Sherman, and it will not only place us under obligations we shall early endeavor to repay, but will be the means of placing on record, where it can always be referred to, an amount of valuable information, which will be of great mutual benefit.—EDS.]

New Gas Company.

We understand the Providence Steam and Gas Pipe Company, of Rhode Island, have contracted for, and are erecting gas works at Corry, Erie County, Pa. H. A. Branch, Esq., agent of the company at Syracuse, has charge of the business. A. F. Kent, Esq., of Kent, Brothers, the well known oil refiners, is President of the new association, called the Corry Gas and Water Company, who are engaged in the laudable enterprise of supplying Corry with the great essentials to comfort and luxury, gas and water.

The proprietors of the Providence Steam and Gas Pipe Company are evidently more than ordinarily enterprising. We hear that they have also recently made contracts for lighting the cities of Minneapolis, Minnesota; and Towanda, Pa This company has built and put in successful operation about sixty gas works; besides carrying on their extensive manufactory of steam and gas work of all kinds, at Providence, R. I.

Metalline—A New Invention.

A number of scientific and practical gentlemen connected with manufacturing and other machinery, have been for several months watching the operations in this city of an invention that aims at the entire abolishment of oils and all other lubricating material for boxes slides, and every condition of motion where metallic friction is to be overcome or expected. It is claimed that such a result has been fully achieved, and there are engines now running with this material, that the proprietors aver have worked to complete satisfaction for weeks and months. Such, in general terms, is the claim of this novel invention. It is the work of a scientific and practical gentleman, well known here and in Europe, who has spent a great many years in the study of physical forces and their effects, with especial reference to metals. The exact nature of the present invention cannot be given, for the reason that patents are being sought for in several countries in Europe, and any clear description of the materials and processes would be likely to defeat that end. It may, however, be said, in a general way, that the discovery—which has received the name of metalline—consists of such combinations and manipulations of various metallic substances, as to make a surface on which the ordinary journals, axles, crank pins slides, etc., of iron, steel, brass, or any other metal, will run with much less fric

tion, without heat that comes within the slightest possibility of danger, and without increase (in fact an actual decrease is claimed) of the motive of power used. These, briefly, are the claims, and the inventor refers to a large number of trustworthy gentlemen who have examined and tried the thing, and speak from actual knowledge.

Supposing this invention to do what is claimed for it, the wide extent of its use and its real value to the world may warrant the statement made by an eminent engineer, that its importance is above that of any of the great discoveries of the time. In the silk, cotton, and woollen mills of this country alone, the use of oil subjects manufacturers to large losses on goods spoiled by it, to spontaneous combustion where it is not constantly watched, and to heavy expenses for the cost and application of lubricants. On railroads disastrous accidents have often occurred, and annoying delays have been endured from hot axles; and wherever wheels revolve we hear shrieks for grease that indicates neglect, superfluous wear, and perhaps immediate danger. Now, if we could run axles of Bessemer steel in boxes of Rockland Lake ice, the dangers, delays, and detentions of friction would be avoided. If this Metalline proves to be all that is claimed for it, these same losses and dangers may be avoided by its use. We are told that a company has undertaken to put this discovery in practical use in a public way as soon as the proper arrangements can be perfected. How far this invention will fulfil these conditions remains to be made manifest to the public.—*New York Bulletin.*

Production of Artificial Jewels.

At a recent meeting of the Academy of Sciences, a highly interesting paper on this subject was received from M. M. A. Gaudin, well known to the scientific world for his researches on the molecular theory. The author is not the first in the field in the art of producing artificial stones.

Some twenty years ago, the late M. Ebelmen manufactured sapphires and emeralds in his laboratory. M. Gaudin's are intermediate in hardness, they have the same brilliancy and a certain fineness. The base he employs is alumina, but mixed with other substances, so that they have not the transparency of oriental jew- which can only be obtained by alumina alone. But this earth is extremely subject to devitrification; moreover, it only melts at a very high temperature, and instead of passing through a pasty state, like glass, it suddenly becomes fluid, like water, begins to boil, throwing off sparks all the while, and then evaperates, disappearing rapidly like camphor. Hence, in order to give ductility to this strange material, It is absolutely necessary to add a strong proportion of silica to it, which prevents it from crystalizing, but then the hardness of the compound is very much reduced, though it still is comparable to hyaline quartz. By employing the oxy-hydrogen blow-pipe on a support of charcoal, the inconvenience alluded to may be avoided; but then the operator incurs another, which is that of bubbles that often remain imprisoned in the viscous substance. Giving a color to these artificial stones is another difficulty; compounds of gold, silver, and palladium cannot be used, because, under the influence of this great heat, these metals are immediately revived. Copper is the most manageable of all, and will give many tints. Manganese and nickel always yield an orange yellow; chromium yields blue and green. The stones produced by M. Gaudin are sapphires, rubies, emeralds, topazes, peridotes, colorless diamonds, and aqua marine.—*Morgan's Brit. Trade Journal.*

Recent American Patents.

Pertaining to Gas, Water, Etc., from the 30th April, to the 7th May, 1870.

101,973.—Steam Generator.—J. F. Belleville, Paris, France. Patented in England June 15, 1866.

101,996.—Turbine Water Wheel.—D. W. Glendinning, Detroit, Mich.

102,010.—Expansion Joint for Pipes.—J. Evans Jones, Tidioute, Pa.

102,056.—Water Wheel Regulator.—J. P. Sibley and A. Walsh, Bennington, Vt.

102,060.—Turbine Water Wheel.— t Stover, Crystal, Mich.

102,116.—Non-Conducting Covering for Steam Boilers. —Washington Harris and Wm. Howell, Phil'a, Pa.

102,120.—Faucet.—Joseph Heine and John Vonficht, Toledo, Ohio.

102,140.—Rotary Pump.—Henry W. Mather, New York city.

102,147.—Safety Valve.—H. J. Paine (assignor to himself and Joseph Kelly), Providence, R. I.

102,169.—Vapor Burner.—Charles E. Smith and H. J. Rice, Columbus, Ohio.

102,174.—Governor Valve.—William Smith, Phil., Pa.

102,190.—Pump.—B. F. Gustin, Middletown, Ind.

102,203.—Apparatus for Mixing Hydrogen and Air.—Daniel Ashworth, Wappinger's Falls, N. Y.

102,234.—Direct-Acting Engine.—C. P. Deane, Springfield, Mass.

102,251.—Vapor Burner.—Franklin Gould, Patterson, N. J., assignor to himself and W. C. Gould, St. Louis, Mo.

102,258.—Gas Heater.—L. B. Hamilton, Boston, assignor to E. A. Eaton, Winchester, Mass.

1fi2,272.—Steam Condenser.—T. L. Jones, Natchez, Miss., assignor to himself and Joseph Mitchell. Antedated Oct. 26, 1869.

102,284.—Mode of Lighting Street Lamps.—Hiram Lennox, Trenton, N. J.

102,287.—Steam Generator.—John C. Ludwig, Stockton, Cal.

102,293.—Gas Generator.—Archibald L. McKay, Bolton, Mass.

109,305.—Street Lantern.—Joseph Neumann, Philadelphia, Pa.

102,335.—Vapor Burner.—Thomas Tully, St. Joseph, Mobile.

102,339.—Vapor Burner.—Thomas Ward, Franklin county, Ohio.

102,342.—Lamp Burner.—James S. Wetherby, New York city.

102,350.—Pressure Gage.—E. A. Wood, Utica, N. Y. Antedated March 19, 1870.

102,355.—Lamp Burner.—Philander Baker, Chicago, Illinois.

102,367.—Variable Cut-off Valve Gear and Valve.—William Brown, Hoboken, N. J.

102 391.—Lubricator.—Gregory Gerdom, N. Y. city.

102,433.—Low-water Indicator.—P. W. Reinshagen (assignor to himself, Daniel Wiehl, Andrew P. Lusk, and John H. Buckman), Cincinnati, Ohio.

102,442.—Pump.—J. A. Sinclair, Woodsfield, Ohio, assignor to himself, Samuel L. Mooney, same place, and William W. Jordan, Ottawa, Kansas.

102,452.—Pump.—Henry Wadsworth, Duxbury, Mass.

102,458.—Pump.—J. E. Wilson, Bridgeport, Conn.

Croton Water.

An analysis of the Croton water, recently made by Professor Chandler, gave the following results for one United States gallon of 231 cubic inches:

Soda	0.326	grains
Potassa	0.097	"
Lime	0.988	"
Magnesia	0.524	"
Chlorine	0.243	"
Sulphuric acid	9.822	"
Silica	0.621	"
Alumina and Oxide of Iron	a trace	
Carbonic Acid	2.604	"
Water in bicarbonates	0.532	"
Organic and Volatile matter	0.670	"
Total	5.027	"
Less oxygen, equivalent to the Chlorine	0.054	"
	6.883	"

These acids and bases are probably combined in the water, as follows:

Chloride of Sodium	0.402	grains
Sulphate of Potassa	0.179	"
Sulphate of Soda	0.260	"
Sulphate of Lime	0.158	"
Bicarbonate of Lime	2.670	"
Bicarbonate of Magnesia	1.913	"
Silica	0.621	"
Alumina	a trace	
Oxide of Iron	a trace	
Organic matter	0.670	"
Total	6.873	"

On evaporating a gallon of this water a residue of only 4 78 grains is obtained, the bicarbonates of lime or magnesia being left as simple carbonates.

The total area of the known or explored coal-fields in the civilized world, independent of our American coal-fields, are less than 20,000 square miles. When compared with the immense areas and extent of the latter, how small and insignificant the former appears.

MISCELLANEA.

The Superintendent of the Brooklyn Bridge Company thinks that it will take five years to complete the bridge. The machinery for the construction of the towers will cost $150,000.

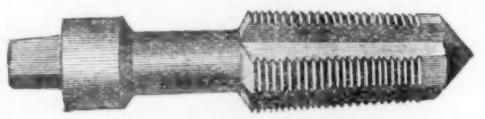
The Pneumatic Transit Company of New York lights the interior of its experimental car with a piece of zircon, against which two jets of hydrogen and o oxygen are made to play, from two cylinders in which these gases are carried condensed. The light is intense and burns steadily without adjustment for seven hours. One zircon pencil (or wick) will last three months.

Haw to Procure Ice.—Nearly fill a gallon stone bottle with hot spring water (leaving room for about a pint), and put in 2 oz. of refined nitre. The bottle must then be stopped very closely, and let down into a deep well. After three or four hours it will be completely frozen; but the bottle must be broken to procure the ice. If the bottle is moved up and down, so as to be sometimes in and sometimes out of the water, the consequent evaporation will hasten the process.

Carbonizing Wood in Vapors.—People sometimes do odd things and arrive at strange and unexpected results. What M. Slidot was driving at when he carbonized wood in the vapor of sulphide of carbon we cannot imagine, but it ended in his obtaining charcoal, which when struck is as sonorous as a piece of metal. He then got a bell turned in wood, carbonized it in the same way, and has an instrument which gives a sound like that of a silver bell. The carbonization is only superficial, and possibly the bell may not be very brittle, as it certainly would be if it were complete. Besides sulphide of carbon, the author calcined wood in the vapor of wood spirit, and so obtained a fibrous coke of silky whiteness. This is a very curious result; white coke is a novelty, and it would be interesting to know for certain what does happen when wood is heated to a carbonizing temperature in the vapor of wood spirit.—*Mechanic's Magazine.*

NOTICE.—WILL CHARLES GREENE, WHO had an Electrical Engine on exhibition at the late Mechanics' Institute Fair in this city, please send his address to the Editors of this Journal, and oilge.

Will CHARLES JONES of Philadelphia, who sent us a comunication a few weeks ago, about Hydrogen Gas Apparatus, please communicate his present address.



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It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizens' Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and Providence Gas Light Company, Providence, R. I.
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I offer this superior coal to Gas Companies throughout the United States—SUPERIOR TO ANY. See analysis by Engineer Manhattan Gas Light Company of New York in the "Gas-Light Journal" vol. X., No. 218, p. 217. Orders solicited from Gas Companies, Gas Manufacturers, and shippers of Coal by the cargo
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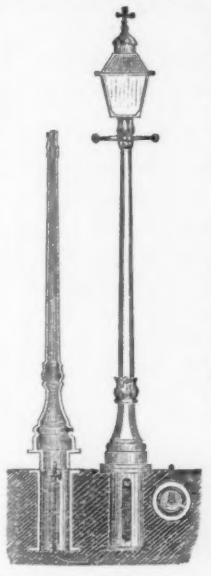
THE ADVANTAGES OF THIS PATENT POST over the old style, are as follows:



1st. The saving of the base or bottom part of the Post, when the column is broken, the Post being made in two parts. The broken column can be replaced by a new one, without disturbing the base.

2d. When the old style of post is broken, the bottom piece has to be dug out, which cannot be done in winter, or in wet weather: all this is obviated in this Post, as no digging is required. This style of Post is especially desirable when flag stone sidewalks are used.

3rd. When a stoppage of gas in stand pipe occurs, the column can be lifted out, the pipe detached, cleaned, and replaced in fifteen minutes; no digging being required as is now done with the old Post.

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Certificate.

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I have examined a new Lamp Post, the Branson patent, and unhesitatingly pronounce it to be the best thing of the kind I have ever seen. Posts of this description have been erected in this city, and in my opinion this style of Post should be universally adopted, as I believe it possesses all the advantages claimed for it.

The St. Louis Gas-Light Company have adapted this Post and ordered a large quantity for immediate use.

THOMAS PRATT,
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This Coal has an illuminating power of 19 candles, yielding over 10,000 cubic feet of gas to the ton, and a large amount of excellent Coke.

Refer to the Manhattan Gas-Light Company, New York, and the New York Gas-Light Company, New York.

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Consulting Chemist,
Geologist and General Scientist,
PROFESSOR HENRY WURTZ.

[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

MONDAY, MAY 16, 1869.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS* or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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ABOUT EXHAUSTERS.

Although exhausters are now deemed instruments of paramount importance in gas works, particularly those of any considerable size, it is somewhat strange that so many companies refrain from procuring them. The testimony of those who have employed them for some time, as well as those who have recently adopted them, is identical as regards the beneficial results of their working, and the verdict in their favor is unanimous. It will be seen in our present issue, under the heading of "Gas Items," that several Eastern gas companies have put in exhausters; still there are many where the exhausters ought to be performing its mission of economy, are still without it, and no effort is made to effect the saving which it is well known this apparatus can, and in other works do perform.

It would seem almost useless to enter into any detailed argument here, to show the advantages of the exhauster, as these are generally acknowledged, and few would have the temerity to deny them. But in gas works where gradual additions have from time to time been made to their capacity, the exhauster should at once be employed. In these places where gas works were formerly of limited extent, the use of exhausters was not felt to be indispensable as it would have been, had they been originally constructed of their present size. At the present time, however, the engineers and superintendents of such works should be aroused to a sense of the importance of such a reform, thereby manifesting a degree of enterprise in the introduction of improved forms of apparatus, becoming convinced that true economy is thereby promoted.

It is plain to the comprehension of every reasonable mind, that in gas works of considerable extent, the degree of pressure in the retorts and hydraulic main must be very great, unless suitable means are employed to reduce it. As a consequence of this under compression, a large deposition of valuable carbonaceous matter occurs in the retorts, and leakage is also likely to ensue. Moreover, in addition to the loss of these luminous hydrocarbon vapors, the retort itself is in danger of being rapidly burnt out, in the process of removing this deposition. These occurrences are familiar to most gas engineers, and do not need enlargement here. They prove, however, the necessity of obviating the evil, and the exhauster is the apparatus which will afford the remedy.

The introduction of an exhaust apparatus is due to Mr. Grafton, whose name is familiarly known in the annals of gas-lighting. In the use of the peculiar fire-brick retorts which are designated by his name, he had for a long period noticed the deposition of carbon in considerable quantities, the cause of which was at that time not properly understood. Mr. Grafton commenced a series of experiments in 1839, with the view of determining the cause of the deposit, and in the course of his investigations sought eminent scientific counsel. The first impression respecting the difficulty, led to the belief that the deposit was caused by unduly heating the retorts, and the exposure of too great an extent of heated surface. These opinions, however, did not satisfy Mr. Grafton, who patiently prosecuted his experiments until he arrived at the correct conclusion, and discovered the real cause of the deposit to be, the great pressure on the retorts, caused by the resistance offered to the gas by the condensers, purifiers, and gas-holders. During the continuance of the experiments the amount of carbonaceous matter deposited was equal to 1 3-10ths per cent. of the coal carbonized. The theory that the formation of the deposit was caused by the compression of gas, was confirmed by removing the gas as soon as generated, when the interior of the retorts was found clean, even after a protracted period.

Mr. Grafton's exhauster was somewhat similar in construction to a wet meter, caused to revolve in an opposite direction by mechanical means. It was made to combine the advantages of a purifier also, by using milk of lime as the liquid. This apparatus was well adapted to the purpose for which it was intended, but it required too great power to work it, which rendered its adoption a matter of considerable expense. The exhauster known as Mackenzie's is generally employed in this country. They are manufactured by the Smith & Sayre's Manufacturing Company, 95 Liberty street, New York, It performs its office with the least possible amount of power, and is a very reliable machine. We observe they have recently attached to their compensator a new governing apparatus, which regulates the speed of the engine by the make of gas; dispensing with the services of an engineer, which we should deem a very important item, especially in small works.

A difference of opinion exists as to the proper position of the exhauster in the works. Some engineers prefer placing it between the hydraulic main and the condensers, while others locate it between the condensers and the purifiers. The former arrangement seem to meet with considerable degree of favor, and in most establishments it is adopted. One objection which is urged against exhausters, is the power which is required to run them; but we think this is much overrated. In works where steam power is already employed, the additional task which would be imposed by an exhauster is but a trifling matter, compared with the advantages which are sure to follow; and in those where steam has not been introduced, it might be employed to effect a saving in other departments, and at the same time be used to propel an exhauster. But be this as it may, it is a fact patent to the minds of enlightened engineers, that this apparatus is a great auxiliary to the economical generation of gas, and it should be more extensively used than it is at present. It behooves the superintendents of gas companies to be on the alert, and to employ any really valuable labor saving appliances, and among these the exhauster, heretofore too much neglected, should surely be included.

AQUA PURA.

"Water, water everywhere,
And not a drop to drink."

The British Journals of Practical Science are just now greatly exercised by the immensely vital questions that have long been agitated in their communities regarding the continually increasing contamination of their rivers, and of the waters supplied to their cities. It is feared that in many cases the movement is somewhat analogous to many previous exemplifications of the principle of "locking the stable after the horse has been stolen." Immense manufacturing, mining, and other operations, of incalculable importance, have now such complete possession and control of the water-courses everywhere, that the labor and expense of mending matters is found to be appalling. To illustrate, we give, notwithstanding its personalities, the following extracts from the issue of April 26, 1870, of the London *Journal of Gas-Lighting*, which represents also the interests of "Water-Supply and Sanitary Improvement" in the United Kingdom. It will be observed that Doctors disagree most emphatically on some of the radical points. Dr. FRANKLAND has even gone to the extreme lately of putting forth the deduction from his own investigations that the

noxious matters communicated to water by decomposing organic matters are practically *indestructible;* so that for example, deposits of a past geological era charged with organic remains (not yet fully decomposed?) may be capable of contaminating and poisoning water leached through them. FRANKLAND's record imparts the gravest importance to any view seriously entertained by him on chemical questions, but we shall not, at the present time discuss this geological view. The words of our London contemporary show that, even to "draw it mild," the picture is bad enough. Practically we have but to deal with the filth and rottenness proceeding from the races of creatures now existent.

* * * No doubt our rivers are in a most deplorable condition. They are obstructed by weirs and dams; they are silted up with ashes and refuse; they are poisoned by the waste liquors of manufactories, mines, and the sewers of populations dwelling on their banks. The amazing thing is that, after the vast sums expended on a preliminary inquiry, the practical results are so minutely small—in fact, nothing but a reproduction of old tales, vague suggestions, and of the evidence already exhausted. The Royal Sanitary Commission—the first Rivers Commission—was, it may be remembered, broken up by an open quarrel between Mr. Rawlinson and Mr. Harrison. It was recomposed of Dr. Frankland, the chemist, so well known by his sensational reports on the metropolitan water supply, who was supposed to supply the science; Sir W. Denison, ex-governor successively of two colonies of Australia, and last of Madras—a very clever man, but, as his recently published book, "Varieties of Vice-regal Life," shows us, positive about matters of which he knows nothing as on those he well understands—who was to find administrative ability; and Mr. John Chalmers Morton, editor of the *Agricultural Gazette*, who was to find agricultural knowledge. They visited all the principal towns on the north and south shores of the Mersey up to Runcorn; then Manchester and Salford; then the towns in the valley of the Irwell, and all the othur rivers and streams of that manufacturing district up to Burnley, on the Ribble. They also visited all the towns and places where attempts have been made to utilize sewage. The first part of the report describes the district they had to examine, and relates the experiments made by Dr. Frankland in his laboratory, with water and sewage in bottles (!), for the purpose of disproving the opinion of such chemists as Letheby, Odling, and Lawes that sewage sufficiently diluted in a running stream eventually becomes innocuous. Considering that Dr. Frankland had made up his mind on the result before he began his experiments, it is scarcely necessary to say that they entirely bore out his original theory. The second part of the report refers to the water supply within the Mersey and Ribble basins. Although printed in 1870, a very faint allusion is made to the miserable failure of the Manchester water supply in 1868. On the necessity of employing sewage in irrigation our views are well known.

* * * * * * * *

The three commissioners could not agree in their report as to the government to be adopted to cure acknowledged evils. Sir William Denison is in favor of a local, the other commissioners of a central Board. They conclude by recommending—and here we, in a great degree, agree with them—that the casting of any solid matters into rivers and running waters be absolutely prohibited under penalties; that all rivers and streams in England be placed under "an authority" central, say Frankland and Morton—composed of not more than three persons; local and elected, says Denison—qualified to deal with all questions of pollution and water supply. The central authority to report on all schemes of water supply to a Secretary of State. On this it may be remarked, that while a local Parliament elected out of the parochial officers, of river valleys would be unwieldy, our past experience of official engineers leads us to distrust a trio selected from the very second-rate engineers who have the ear of the Health Department of the Home Office.

From this it is our wish to deduce a lesson. The time is at hand, at least for many of our own rapidly growing communities, when the "iron hand of necessity" will be felt, and the instinct of self preservation from this quarter. Let it not be put off too long. There is no section of the land to which these remarks are more pertinent than the neighborhood of New York. It is true that the Metropolis itself, through natural advantages and wise and timely precautions of past rulers, has been placed for a long period to come beyond the probability of any such pressure; but we refer now to the immense suburbs that are growing up on every hand, which will before many years overshadow the city itself, and are fast absorbing even now that portion of its population which most needs pure and copious water supply. Without particularizing at present, as we shall return to this subject after and in detail, we shall close for the present with the suggestion of a moral to be drawn from the *universally broken* drinking fountains all through the lower half of New York city, which are daily hurried by with utter indifference by tens of thousands of "business men" who would have not a moment's peace of mind did they realize that their quiet homes across the North or East River were supplied with water that had received the drainage from a privy, or the essence of a rotten canine carcase!—H. W.

SPECIAL NOTICE.

The Editor of this Journal has the control and disposition of a new and valuable patent. It is a lamp adapted for burning kerosene, or any of the cheap and coarse oils. The lamp is spherical, and is constructed with an outer casing, opening through narrow slots at the base of the wick, and with a matrix to screw on to iron pipes, like gas burners. The design is that the iron pipes should be filled with atmospheric air, to be admitted to the lamp by turning a cock, just as when gas is used. A gentle current of air being forced through the pipes strikes upon the flame of the lamp, causing a strong and steady light, free from smoke and of great brilliancy. A flow of air sufficient to fill the pipes of a large building can easily be obtained by means of a twelve-inch rotary blower placed in the cellar, wherever (as in the case of factories and hotels) water or steam power can be obtained for turning the blower. A current of air can also be obtained and applied by a rubber tube to single lamps, by the simple and cheap contrivance known as "the Catalan Blast," wherever there is a water cock and waste pipe near at hand. The lamps must of course be unscrewed, filled, and trimmed every day. But this is an inconvenience of little account, in view of the economy of the arrangement, and the advantage of obtaining a light of such brilliancy, from the use of safe and cheap oils.

THE SYNOPSIS OF BRITISH GAS LIGHTING AND MATRIMONY.

Under the head "Correspondence" in the REPERTORY columns, will be found a letter from James R. Smedberg, Esq., dated San Francisco, written to William Farmer Esq., the able and well known photometrician of the Manhattan Gas-Light Company, New York.

Mr. Smedberg incidentally remarks in this letter that the "Synopsis is well advanced." This we know will be gratifying news to the subscribers, who have waited so long patiently. We are not aware that any one else has taken up the Synopsis, and trust, therefore that it will soon be published and ready to deliver.

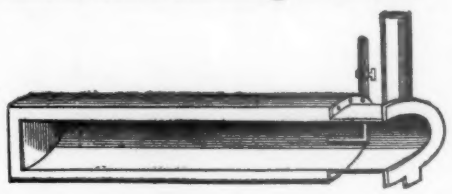
Another item of information which will be of pleasing interest to all the numerous friends of Mr. Smedberg is, that he has recently married one of the fairest and most accomplished ladies on the Pacific coast; the daughter, we understand, of a prominent merchant of San Francisco.

Errata.

In our last issue two errors occurred in the editorial article on "The Utilization of Heavy Hydrocarbons, for Increasing the Light of Coal Gas," page 137. In the second paragraph, instead of 75 it should be 74 Maiden Lane, and in the same paragraph 11th line, commencing "now gets from a four foot chandelier," for foot read *light*.

A. HAMAR'S

Anti-Carbonizing Process.



All persons wishing information relating to the above process, must apply to Messrs. STUART & PETERSON, corner of Fourteenth and Noble Streets, Philadelphia, as they have bought from me the full right and control of said patent.

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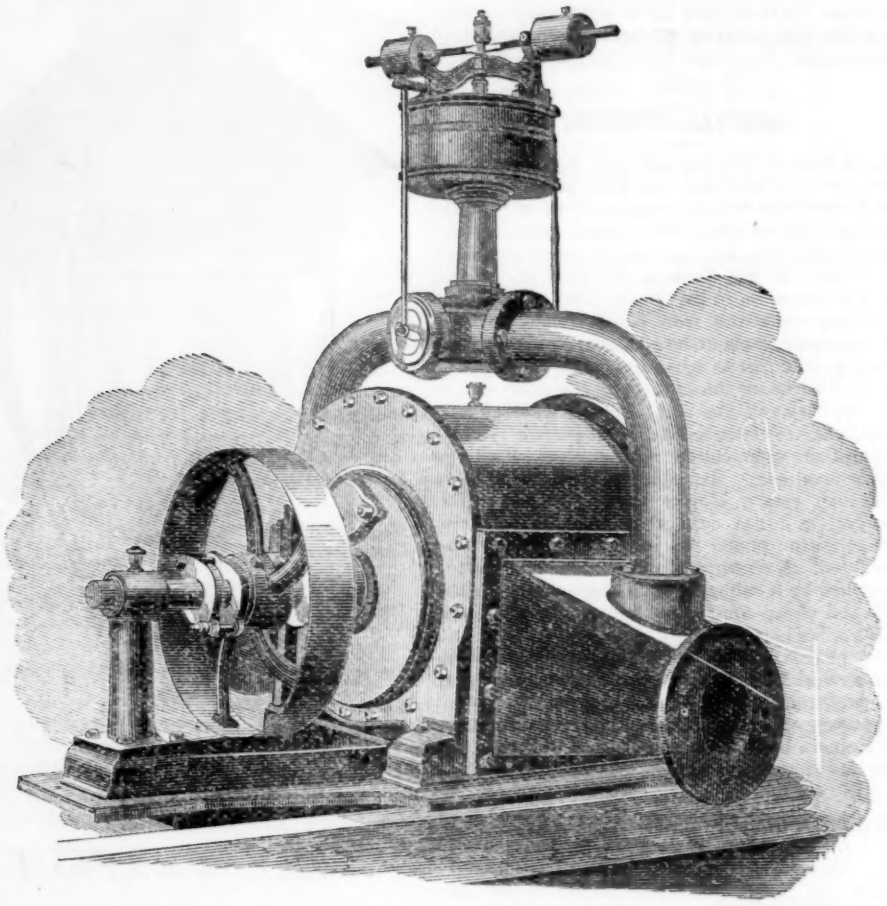
Smith & Sayre Manufacturing Company.

The Mackenzie Patent Gas Exhauster,
AND PATENT COMPENSATOR.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

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The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary Fan. The Cupolas are manufactured in sizes to melt from 1 ton to 25 tons per hour, will save one quarter of the time required by the old style Cupola, and 33 per cent. fuel. Address

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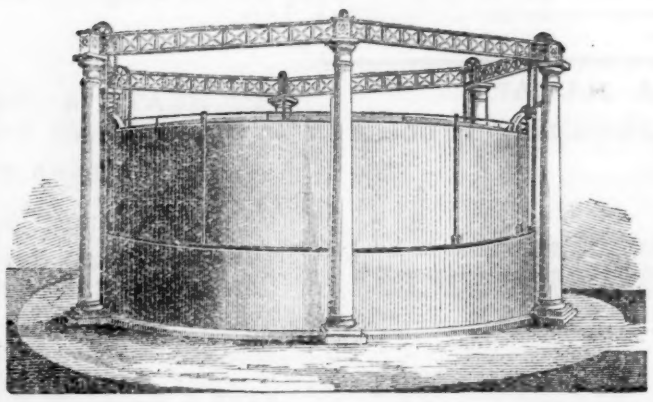

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FIG. 1.

Fig. 1 shows a single gate valve.

Fig. 2 represents wedge and one-half of gate of double valve, intended for larger sizes, when required to bear heavy pressure either side.

Fig. 3, represents a section through body, gate and wedge.

The slides, G G, are held against wedge D, by ribs, H H, projecting from sides of valve body, A.

In closing the valves, when opening I is covered, slides, G G, pass the lower ends of ribs, H H, when the wedge, D, can move forward on the inclined planes E E, and crowd the gates apart.

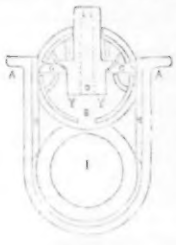

FIG. 3.

FIG. 2.

[From A. F. Havens, Engineer Brooklyn Gas-Light Co.]
"I take great pleasure in saying that they give perfect satisfaction—opening easily and quickly, and requiring no effort to start them, even after they have been closed for months."

[From R. E. Roberts, Secretary Detroit Water Works.]
"Commenced using your valves in 1866; have over 200 in use: have given satisfaction."

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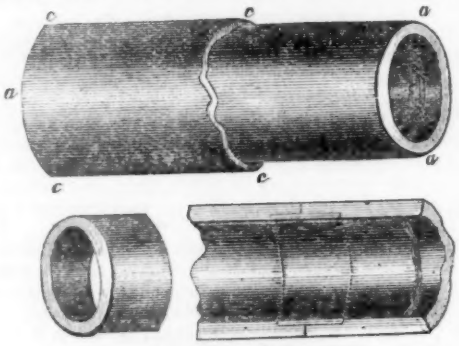

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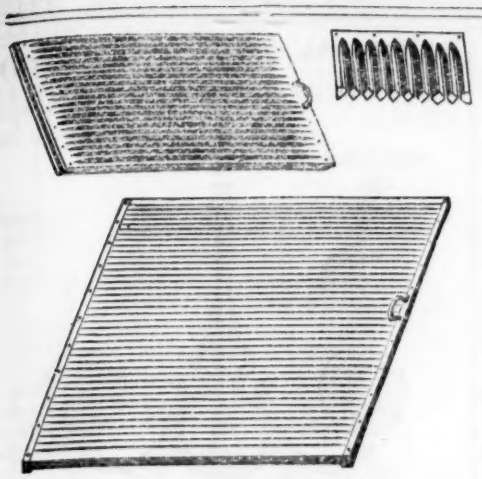

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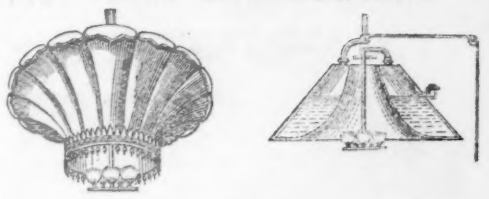

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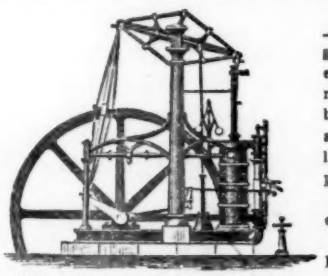

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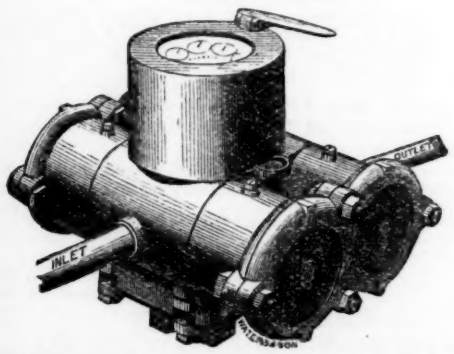

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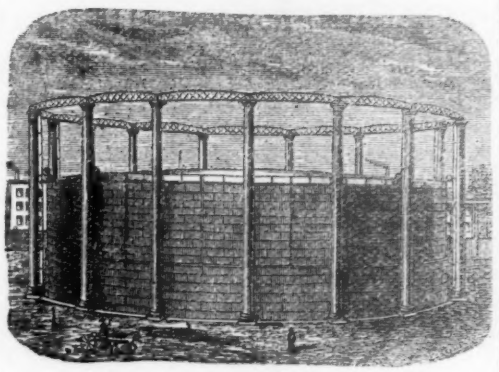

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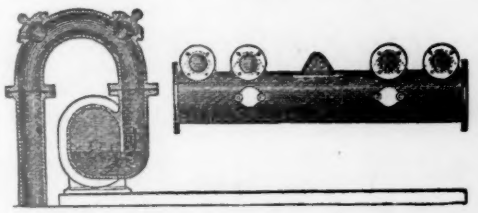

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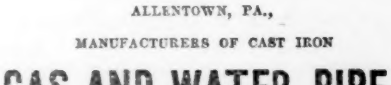

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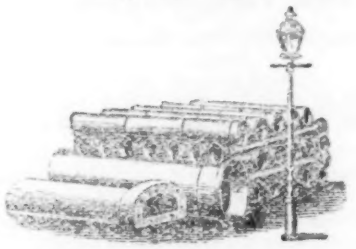

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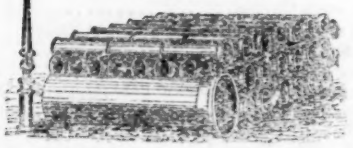

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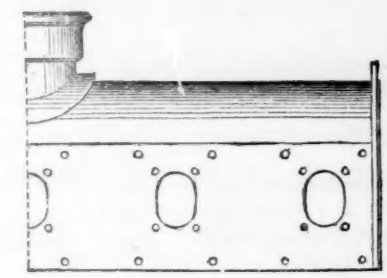

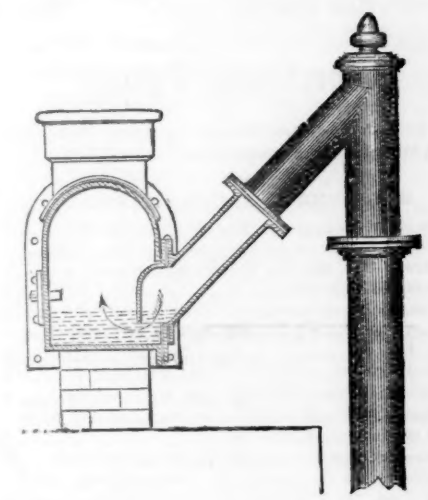

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